KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.Tech.
Year : III

Course : ENVE 302
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date 18 DEC 2024

SECTION "A"

[20 Q. × 1 = 20 marks]

Make reasonable assumptions for any missing data or information. Encircle the best answer.

1. The term "per capita demand" in water supply refers to:
   a. The total water required for industrial use
   b. Water required for one person per day
   c. Total water demand of a city
   d. Total water used in agriculture

2. If the population of a city grows from 20,000 to 30,000 in 20 years, calculate the average annual growth rate using the arithmetic increase method.
   a. 400 persons/year
   b. 500 persons/year
   c. 600 persons/year
   d. 700 persons/year

3. The design period for a water supply project is typically:
   a. 5-10 years
   b. 10-20 years
   c. 20-30 years
   d. 50-100 years

4. Which of the following is the used to measure Suspended solids?
   a. turbidity rod
   b. gravimetric test
   c. chromatography
   d. jackson's turbidity meter

5. The first step in water treatment for municipal supply is:
   a. Filtration
   b. Coagulation
   c. Sedimentation
   d. Screening

6. Which of the following is a coagulant commonly used in water treatment?
   a. Chlorine
   b. Alum
   c. Lime
   d. Soda ash

7. In slow sand filter, the turbidity of raw water can be removed only upto
   a. 60 mg/l
   b. 75 mg/l
   c. 100 mg/l
   d. 150 mg/l

8. The Biological Oxygen Demand for safe drinking water must be
   a. 5
   b. 10
   c. Nil
   d. 15

9. Which law governs the flow of water through pipes?
   a. Newton's Law
   b. Bernoulli's Equation
   c. Darcy-Weisbach Equation
   d. Fourier's Law

10. A sedimentation tank has a length of 30 m, width of 10 m, and a depth of 3 m. If the flow rate is 0.5 m^3/s, calculate the detention time.
    a. 30 minutes
    b. 45 minutes
    c. 90 minutes
    d. 120 minutes

11. A rapid sand filter is backwashed when:
    a. The turbidity of output water decreases
    b. The turbidity of output water increases
    c. The head loss in the filter decreases
    d. The flow rate of water increases

12. A rapid sand filter has a bed area of 10 m^2 and a filtration rate of 5 $m^3/h/m^2$. What is the total flow rate through the filter?
    a. 40 m^3/h b. 50 m^3/h c. 60 m^3/h d. 70 m^3/h

13. The most effective method for removing pathogens in water is:
    a. Sedimentation b. Filtration c. Boiling d. Chlorination

14. Which type of pump is most suitable for lifting water from deep wells?
    a. Centrifugal pump b. Jet pump
    c. Submersible pump d. Piston pump

15. The capacity of a service reservoir depends on:
    a. Peak demand b. Average demand
    c. Minimum demand d. Population density only

16. The Hazen-Williams equation is used to calculate:
    a. Velocity of flow in open channels b. Friction loss in pipelines
    c. Pump efficiency d. Head loss due to valves

17. The total head loss in a 500 m pipeline with a flow rate of 0.2 m^3/s and a friction factor of 0.02 is approximately:
    a. 8m b. 10 m c. 12 m d. 14 m

18. The detention time in a sedimentation tank is typically:
    a. 1-2 hours b. 4-8 hours c. 12-24 hours d. 30 minutes

19. What is the primary purpose of aeration in water treatment?
    a. Removal of bacteria
    b. Removal of suspended solids
    c. Removal of dissolved gases and volatile substances
    d. Coagulation of impurities

20. The term "residual chlorine" in water treatment refers to:
    a. Chlorine that reacts with organic matter
    b. Chlorine that remains in water after treatment
    c. Chlorine that reacts with ammonia
    d. Chlorine that settles at the bottom

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F. M. : 55

SECTION "B"
[6 Q. × 8 = 48 marks]

Attempt ANY SIX questions. Make logical assumptions wherever required.

1. Define Portable and Wholesome water. List the different types of sources of water. What are the objectives of water supply system? [2+2+2]

2. The recent survey data collected in 2024 for a water supply scheme in a village of Nepal is given below.
   i. Population of base year = 250
   ii. Design Period = 15 years
   iii. Average population growth rate = 1.5%
   iv. No. of cows = 100
   v. No. of chicken = 800
   vi. No. of day scholar in school = 75
   vii. No. of boarder in school = 10
   viii. No of health post = 1

   Based on the data, calculate the total water demand for the village. Assume required information.

3. Determine the settling velocity of discrete particle having diameter 0.14 mm, specific gravity 2.61 in water at temperature 25^0C.

4. Design a rectangular plain sedimentation tank to treat 2 million liters of water per day. Assume 2 hours detention period and 2 m depth.

5. What is the function of a filter? Compare the major features of three types of filter commonly used in water treatment. Which type of filter you would choose for a small village which has very low population growth. [1+3+2]

6. Explain briefly about Aeration, Flocculation and Disinfection. [2+2+2]

7. A village has design year demand of 90,000 lpd. The demand is to meet by a continuous system of supply. The water tapped from the source is 1.4 lps. Calculate the capacity of balancing tank. The consumption pattern is as follows.

Time (hours)	Consumptions %
5-7	25
7-12	35
12-17	20
17-19	20
19-5	0

P.T.O.

8. Discuss the most suitable type of design a water supply system, layout, storage solutions, and distribution method while addressing challenges like landslides and gravity flow utilization in a hilly region with significant seasonal variation in rainfall that ensures year-round water availability.

SECTION "C"
[7 marks]

9. Find the length of an equivalent pipe of diameter 400 mm for the network shown below.